ATTORNEY DOCKET NO. 8452-20096

SOAP AND PROCESS FOR CLEANING WASH WATER

CROSS REFERENCE TO RELATED APPLICATION

This application claims the benefit of my prior co-pending Provisional patent application serial number 60/438,959, filed 01/09/2003 the disclosure of which is incorporated herein by reference as if fully set forth.

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a washing soap and a method for cleaning the resulting wash water.

Description of the Art

Many industrial operations involve the cleaning of machinery, clothing, building areas, and personal. The waste water generated from these wash operations often contain environmental toxins such as heavy metals, and organic toxins. Many cleaning agents make water treatment difficult, especially when environmental pollutant removal is required.

It is desirable to have a mild nontoxic cleaning agent that does an excellent job of cleaning equipment, building areas, clothing, and personnel . In addition, it is desirable that the same cleaning agent does an excellent job of cleaning the waste wash water in the water treatment area. The cleaning agent itself should place no burden on the environment. The agent should be inexpensive and be readily available throughout the world.

Phosphates have been used as cleaning agents for several years. There have been many attempts to restrict their use because they stimulate algae growth. However, they are required to sustain life.

Fatty acid salts have long been used in the soap industry. Recently soft soaps that are based on potassium fatty acid salts have been introduced.

In earlier patents I have introduced the concept of using fatty soaps as agents to remove environmental toxins. Some municipal water treatment plants have used phosphates to reduce the level of heavy metals in their treated water.

DISCLOSURE OF THE INVENTION

Summary of the Invention

I accordance with my invention agents are used as cleaning agents and also as agents to purify the water in water treatment plants. For example, a lead acid battery manufacturing plant could replace their existing cleaners with this new double duty cleaning agent. This approach has the following benefits:

1. Superior cleaning power;

2. Elimination of cleaning agents(such as detergents and nonionic surfactants) which make water treatment difficult and expensive;

3. Elimination of environmentally toxic soaps such as nonionic surfactants which act as estrogen mimics that harm reproductive health;

4. The customer is already paying for soap. Since the new soap acts as a cleaner and a water treatment agent the overall cost is less for the customer; and

5. By using the soap in all cleaning operations, the customer does not have to worry about variable water treatment quality due to the wide variety of cleaning agents used in industrial applications.

I have invented a soap comprising phosphate salt and fatty acid salts, in combination. The

phosphate salt is selected from the group of cations consisting of: hydrogen; ammonium; lithium; potassium; and sodium; and the group of anions consisting of: phosphate; pyrophosphate; and polyphosphate.

The fatty acid salt is selected from the group of anions consisting of:

any fatty acid having carbons in the range of 6 to 36;

any aromatic acid having carbons in the range of 6 to 36;

branched chain fatty acid;

straight chain fatty acid;

unsaturated fatty acid;

polyunsaturated fatty acid; and

aromatic acid;

and the group of cations consisting of:

potassium;

lithium;

sodium;

ammonium; and

amine.

The soap can be fortified by the addition of an alkaline metal salt that has a pH greater than 7.

I have also invented a process for treating water comprising:

mixing a phosphate fatty acid salt mixture with the water;

mixing a polyvalent metal precipitation agent with the water mixture;

adjusting the pH of the mixture to be in the range of 4 to 9; and

separating purified water from precipitant.

In this process the precipitation agent may be calcium chloride and the pH may be adjusted within a pH range of 6 to 9.

In my process the precipitation agent may be selected from the group of anions consisting of:

polyvalent metal ion;

calcium;

magnesium;

aluminum; and

iron.

In my process there may be an additional step of adding flocking agents to the mixture before separating the purified water from precipitant.

In my process there may be a step of adjusting the pH comprising adding acids, bases or salts.

I have also invented a washing and water treatment process comprising the steps of:

washing articles with soap comprising phosphate salt and fatty acid salts, in combination and water;

and then, treating the resulting soap/water mixture by a process comprising:

mixing a polyvalent metal ion precipitation agent with the soap/water mixture;

adjusting the pH of the mixture to be in the range of 4 to 9; and

separating purified water from the resulting precipitant.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

My invention is a product and a process. In the first step, I wash an object with a potassium phosphate soap. This can be done, for example, by putting the potassium phosphate on a towel in the form of a soap and then washing an object with the towel.

In the extra-clean version of this invention, I use potassium fatty acid salts and potassium phosphate.

Next I rinse the towel and my hands with water. In this case, both would come clean.

I collect the dirty wash water.

Then I add calcium chloride to the dirty water so that all of the soap and dirt precipitate out, leaving only potassium chloride and water. This can be collected by decanting it. This is, in fact, fertilizer.

Upon initial examination, the properties of cleaners and water treatment chemicals appear to be exclusive of one another. Cleaners usually are designed to remove dirt by the promotion of mixing with or dissolution in water via emulsification, suspension, complexation, dissolution, and a host of other mechanisms. Meanwhile, the goal of water treatment is to remove all the dirt from the water. Therefore, the better the soap the harder it is to treat the water. Many common soaps require oxidation or bacterial decomposition to make water treatment even possible.

The best natural soaps actually make the best water treatment agents when processed properly. For example, phosphates emulsify many grease like materials and can soften very hard water. If one treats the dirty wash water with standard water treatment chemical salts (such as magnesium, calcium, iron, aluminum salts) ,the phosphates are converted to highly water insoluble salts such as magnesium, calcium, iron, or aluminum phosphates and nontoxic salts such as sodium sulfate or sodium chloride that have minimal soap or metal complexing properties. In addition,

formation of these insoluble phosphate salts co-precipitate with many toxic metals such as lead, cadmium, or mercury.

I use trisodium phosphate (TSP, a well known cleaner) for cleaning, followed by precipitation with polyvalent metal salts such as aluminum sulfate, magnesium sulfate or calcium sulfate in the water treatments area. This approach leads to reasonable cleaning and a reduction of heavy metals in the treated water to about 80 parts per billion (PPB). However, drinking water standards require even lower heavy metal levels . The standard for lead is less than 15 PPB.

When fatty acid soaps are added to the phosphates both cleaning and water treatment performance are increased. In the case of water treatment, lead levels are reduced to less than 1 PPB.

The use of sodium phosphates and sodium fatty salts have a few disadvantages.

1. Sodium in waste water streams contribute to ground water sodium ion buildup which is toxic to many agricultural plants;

2. Sodium phosphate has inferior cleaning action compared to ammonium or potassium phosphate;

3. Sodium fatty acid salts have inferior cleaning action compared to ammonium or potassium salts; and

4. Sodium fatty acid salts tend to form stiff water gels, such as bar soap, that are inconvenient to use compared to liquid ammonium or potassium salt counterparts.

Potassium salts are preferred over ammonium salts because they have superior cleaning action, are odorless, and do not interfere with water treatment quality. (Ammonium ions tend to form complexes with many metal ions such as copper.)

Potassium ions are nontoxic to plants. Therefore, much higher potassium levels can be

tolerated in waste water streams.

Saturated fatty acid salts are preferred over unsaturated because the saturated fatty acids are easier to remove from water. They also are much more stable to oxidation agents such as bleach.

Many fatty acid salts are effective . Potassium myristate (C12 chain) works . Smaller chain fatty acid salts may work, but have bad odors under acid conditions and have poor cleaning power. Chain lengths shorter than C8 are not recommended. Fatty acid salts with chains longer than C18 (stearate) such as behemate (C22) can work, but require shorter chain fatty acid salts to be effective.

The best formulation is a mixture of potassium stearate (C18) and myristate (C14) with tripotassium phosphate. This mixture can remove dirty grease from cloth, machinery , and hands, while being able to remove heavy metals from the water in the water treatment plant. The formulation is a thick liquid that dissolves easily in water.

In the case of laundry, increasing the pH of the wash water to 10 –13 by adding alkalizing agents such as potassium hydroxide or potassium carbonate, in addition to the above mixture, can improve cleaning performance. In cases where the clothing is acidic or salty, it is more economical to pre-rinse the clothing with water; preferably with deionized water. Pre-rinsing reduces alkalizing demands and improves cleaning performance by reducing salt loading. Deionized or distilled water is preferred over softened water because softened water has elevated salt levels. Other alkalizing agents such as sodium hydroxide are less preferred, because they reduce washing performance.

The cleaning agent removes many kinds of dirt such as a grease, particulate dirt , and food stains. However, some stains such as rust and metal oxides are best removed after the initial cleaning by applying formic , citric, oxalic, lactic , or acetic acid and many other organic acids. The addition of hydrogen peroxide to these acids can accelerate the cleaning action. This mixture also

dissolves many metals and metal oxides, such as lead. Formic acid is preferred because it is easily destroyed with oxidation agents such as bleach. Formic acid and its salts must be destroyed in the water treatment area because they interfere with the removal of metal ions from the water by forming stable complexes.

SOAP FORMULATION:

Material	Amount in grams
Stearic acid	15
Myristic acid	15
Potassium Hydroxide	10
Tripotassium Phosphate	30-100 (30 is sufficient in most cases)
Water	860 - 930
Total	1,000

NOTE: Stearic acid (triple pressed, is a mixture of stearic and palmitic acid).

The use of deionized or distilled water improves the cleaning power of the soap. Softened water is better than hard water, but less preferred than distilled or deionized water because it contains salt.

WATER TREATMENT:

The waste water generated from the cleaning process is pooled together and polyvalent metal salts, such as iron sulfate, are added in sufficient amounts to react with most of the phosphate and fatty acid salts in the soap to form the corresponding metallic salts. After mixing thoroughly the pH is adjusted to the range of 6 – 9 with an alkaline agent such as sodium hydroxide , potassium hydroxide, magnesium hydroxide, ammonia, or calcium hydroxide or an acid such as sulfuric , hydrochloric, or phosphoric acid. Flocking agents can be added to accelerate the rate of coagulation. After the coagulation is complete , the clear water is decanted from the process tank . One may pass

the purified water through a filter such as a sand , cartridge, or diatomaceous earth filter to insure complete particle removal.

Chemical Reaction:

$2\ K_3P0_4 + 3\ Ca\ Cl_2\ =\ 6\ KCl$ (soluble) + $Ca_3(P0_4)_2$ (insoluble)

2 K stearate + $Ca\ Cl_2\ =\ 2\ KCl$ + Ca (stearate)$_2$ (insoluble)

Preferred Precipitation Agents

Nontoxic no environment burden:

Iron Sulfate	yields high quality water
Magnesium Sulfate	
Calcium Sulfate	Cheapest and least toxic, but slow processing
Aluminum sulfate(Alum)	Aluminum toxic to some plants .
	If no excess is used very little aluminum remains in the water.

Slightly less acceptable chloride ion is toxic to many plants at high levels:

Calcium chloride
Aluminum chloride
Ferric chloride
Magnesium chloride

Other agents: oxides, hydroxides, carbonate, bicarbonates of the polyvalent metal ions (such as iron, calcium , magnesium, aluminum) maybe used, but may not be quite as effective or may require supplemental pH adjustment agents.

Flocking agents:

Nalco 7194
20 ml of 0.1% for 100 grams of cleaner
Processing conditions pH 7.5 to 8.5 preferred.
For good lead and phosphate removal levels
Nalco Ultimer 1452 is also effective

NOTE: Calcium chloride at pH = 8 yields the lowest lead levels. Iron salts yield lowest phosphate level.

This invention comprises an agent which has both excellent cleaning power and water purification capability.

The agent also has much better cleaning power than the typical laundry or hand soap.

The high phosphate content which is normally considered damaging because it promotes algae growth, is processed in such a manner that it becomes the primary cleaning and water purification component. The treated water has low phosphate content and therefore does not contribute to algae growth.

The potassium salts have superior cleaning power over sodium salts and unlike sodium salts are nontoxic to plants.

The unique mixture of potassium saturated fatty acid and phosphate salts yields cleaning power and stability not found in other commercial cleaners. Fatty acids of longer or shorter chains have reduced cleaning power.

The best lead results are obtained using calcium chloride as a precipitant and adjusting the pH with hydrochloric acid to pH 8.0 . Lead levels are reduced to less than 1 PPB with a phosphate level of 20 PPM. Increasing the pH to 8.5 yields reduces the phosphate to 1.5 PPM while increasing the lead to l PPB. What follows is a summary and the experimental data.

The combination of phosphates and fatty acid salts to produce lead removal levels much lower than phosphate or fatty acid salts alone could achieve.

Phosphates alone produce 100 PPB lead , Fatty acids alone produce 7PPB lead, The combination produces less that l PPB

The use of phosphate fatty acid salt mixture than can act as a superior soap and subsequently act as a superior water treatment agent when polyvalent metal ions are added.

The phosphates used for the soap include any ammonium or alkali metal salt of a phosphate , pyrophosphate, or polyphosphate. The metal ions include lithium, potassium or sodium. Tripotassium phosphate is the most preferred.

The scope of alkaline metal or ammonium fatty acid salts include any saturated fatty acid salt having 8 to 36 carbons. The fatty acids may be branched or straight chain. The most preferred are potassium fatty acid mixtures. Small amounts of unsaturated or polyunsaturated fatty acid salts can be used to stabilized the soap. Potassium oleate is useful.

The soap may be fortified by adding an alkaline agent, such as alkali metal hydroxides and carbonate. The most preferred is potassium hydroxide.

The precipitation agent can be any polyvalent metal ion including calcium, magnesium, aluminum, and iron. Halogen metal salts yield the best results such calcium chloride , aluminum chloride, and ferric chloride.

The preferred pH adjusting agents are alkaline metals salts or ammonium salts for increasing the pH, including hydroxides, carbonates, bicarbonates, phosphates, polyphosphates, pyrophosphates , silicates. The most preferred is potassium hydroxide. Preferred agents for reducing the pH are mineral acids such as hydrochloric, sulfuric, phosphoric acid or acid polyvalent metal salts such as aluminum chloride , ferric chloride, ferric sulfate, and aluminum sulfate

The invention can be used an as a water treatment agent alone or as soap and subsequently used as a water treatment composition.

For treating water, the process would be:
Add the phosphate fatty acid salt mixture to the water and mix
Add the polyvalent metal ion precipitation agent to the water and mix

Adjust the pH to 8.5 (a pH range 4 to 9 is acceptable)
Separated purified water from precipitant (decant, filter, centrifuge or other separation method)
(Flocking agents can be added to increase the rate of the separation)

This process can be used to remove toxic metals from water such as lead, mercury, arsenic, cadmium, copper, zinc, uranium, nickel, chromium.

For acting as a soap and water treatment the process is:

Wash articles such as clothing, machinery, or soil with soap, then use the same process described for treating water.

LAUNDRY

Laundry development has proved to be economical and effective in washing equipment, hands, clothing, and water. The presence of phosphate and magnesium ions , and adjusting the pH with sulfuric acid to neutral (7.0) yields lead levels of 90 PPB. Magnesium sulfate requires the least amount of flocking agent to produce rapid settling. This part of the composition removes the majority of the lead from the water. The fatty acids act as a polishing agent to remove the last 100 PPB. The addition of fatty acids even short chain C12 Lauric acid produces lead levels of less than 6 PPB. The best results are produced near pH = 7. A pH range of 7 to 9 would be an easy process target and yield good results. The delicate part of the formulation is the fatty acid composition requirements to produce clean clothing. A 50/50 blend of potassium Myristate(C14) and Stearate(C18) salts product the best cleaning results. Other compositions such C14/ C16, C12/C18, C12, C14, C16, C18 produce unstable mixtures or yield poor cloth cleaning results. Phosphate and potassium hydroxide content can be varied and still produced a stable soap with good cleaning ability.

SAMPLE SOAP FORMULAS THAT WORK
Composition of laundry soap per 100ml(balance is water)

Myristic Acid	Stearic Acid	Potassium Hydroxide	TripotassiumPhoshate	cloth cleaning
1.5gram	1.5gram	1	3	excellent
1.5	1.5	1	15	good
1.5	1.5	6	10	OK

This composition is good in laundry cleaning because is requires less soap to increase pH. However, the cleaning power is not as good and it is more corrosive to the skin. It may be preferred to run water through an ion exchange bed to reduce the soap demand.

Sodium salts produce soaps that do not clean quite as well and place a sodium burden on the land.
LAUNDRY SOAP RESULTS

Sample ID	K3PO4	Na3KPO4	Kstearate	Na laurate	MgSO4	AlSO4	pH	lead in PPB

A	X			X		8.7	71
B	X				X	7.0	90
C	X	X		X		8.5	39
D	X	X		X		7.5	less than 5
E	X		X	X		8.0	6

SAMPLE 1(A)
0.5 gram lead oxide
1 gram tripotassium phosphate
500 gram water
mixing and let settle for 30 minutes
pH 11.6
decant
add 4 grams magnesium sulfate heptahydrate mix pH = 8.7 mix 2 gram 7194 0.1% nalco flocking agent mix 2 minute 2 minute settle. Decant through paper filter (settling in 2 minutes)

SAMPLE 2(B)
0.5 gram lead oxide
1 gram tripotassium phosphate
500 gram water
mixing and let settle for 30 minutes
pH 11.8
decant
add0.5 grams aluminum ammonium sulfate
40 grams 0.1% nalco 9174 Nalco
pH 7

SAMPLE 3(C)
0.5 gram lead oxide
1 gram tripotassium phosphate
1 gram K stearate
500 gram water
mixing and let settle for 30 minutes
pH 12.0
add 10 gram Magnesium Sulfate heptahydrate mix pH 9.6
adjust with sulfuric acid to 8.5
10 grams 0.15% flocking agent 7194 Nalco
more bulking than sample 1

SAMPLE 4(D)
0.5 gram lead oxide
1 gram tripotassium phosphate
1 gram K stearate
500 gram water
mixing and let settle for 30 minutes
pH 12.0
add 10 gram Magnesium Sulfate heptahydrate mix pH 9.6

adjust with sulfuric acid to pH 7.5
5 grams 0.15 %flocking agent7194 nalco
more bulk than sample 1

Bulk = Mg PO4 and Mg stearate the rest is soluble in water. For each gram of lead 3 grams of sediment would result.

Sodium Stearate Produces a soap that is too stiff in conjunction with Trisodium phosphate (TSP)
Not usable
SAMPLE 5(E)
500 ml water
1 gram Trisodium Phosphate
1 gram Lauric acid (very soluble sodium salt)
0.4 gram NaOH
0.5 PbO
very uniform easy to settle out lead
pH = 11.6
add 4 MgSO4 7 H2O
adjust pH to 8.0
easy to filter.

The laundry soap continues to yield good results. The water was treated with magnesium sulfate and the pH adjusted to 7. The lead level increase to 83 PPB therefore pH 7.5 may be preferred. The phosphorous level was (385 PPM)
A second sample was treated with iron sulfate and the pH adjusted to 7 this gave low lead 8 PPB and low phosphorus (1.6 PPM). Iron gave the best results in both cases.
Low lead levels are best achieved with calcium chloride as the precipitant and high pH values of 8 to 9 Lead is reduced to less than 1 PPB in some cases. Iron chloride is the precipitant of choice, when low phosphate levels of less than 10 PPM are desired and low lead levels are desired a lower pH value of 6. Iron requires a lot more flocking agent. Calcium carbonate can be used in place of calcium chloride if the pH is adjusted with hydrochloric acid.

Clothes wash well with 100 ml of soap per load and the pH adjusted to 9 with potassium carbonate or potassium hydroxide. Sodium hydroxide or sodium carbonate can be used , but washing power is reduced.

The soap can be used directly as a hand wash and metal part degreaser.

Flocking agent is used at a rate of 5 gram of a 1% solution of Ultimer 1452 per 100 ml of soap used.

The phosphate is the main work horse concerning removing the bulk of the lead , but the fatty acids do the critical role of removing the last 100 PPB from the water.

Three water samples were prepared to confirm the role of pH and iron.

WATER RESULTS:

The water results the alkaline pH such as 8 are preferred for minimizing lead and phosphate levels. As pH decreases ,the level of phosphate increases dramatically however the lead level remains low. Calcium sulfate performs well in reducing lead levels, but phosphate remains elevated. This occurs because the sulfate ion competes with the phosphate ion

The data implies that one could go to pH =9 and have equal or better results. Lower pH levels such 5 or 4 maybe possible,but phosphate level would definitely escalate, unless Calcium Chloride were replaced with Ferric Chloride , Due to the fact that Iron Phosphate even under acidic conditions has a very low solubility.

SOAP FORMULATION:

Material	Amount in grams
Stearic acid	15
Myristic acid	15
Potassium Hydroxide	10
Tripotassium Phosphate	30
Water	930
Total	1,000

Sample **1 (A) Less than 1PPB lead 20.1 PPM Phosphate**

25 ml soap
0.5 gram PbO
500 ml water
mix, and then decant water

Add Calcium chloride solution (0.9 M) 25 grams of 10% solution. And mix
Adjust pH with sulfuric acid to pH = 8

Add 10 ml of 0.2% Nalco Ultimer 1452 and mix. Clumping happens in seconds
Filter water.

Sample **2 (B)(10 PPB Lead, 34.7 PPM Phosphate)**

25 ml soap
0.5 gram PbO
500 ml water
mix, and then decant water

Add Calcium chloride solution (0.9 M) 25 grams of 10% solution. And mix
Adjust pH with sulfuric acid to pH = 7

Add 10 ml of 0.2% Nalco Ultimer 1452 and mix. Clumping happens in seconds
Filter water.

Sample **3 (C)(1.7 PPB Lead 593 PPM Phosphate)**

25 ml soap
0.5 gram PbO
500 ml water
mix, and then decant water

Add Calcium chloride solution (0.9 M) 25 grams of a 10% solution. And mix
Adjust pH with sulfuric acid to pH = 6

Add 5 ml of 0.2% Nalco Ultimer 1452 and mix. Clumping happens in seconds
Filter water. Lower pH requires less flocking agent. This filters the fastest and dewaters the easiest

Sample **4 (D) (1.20 PPB lead , 497 PPM Phosphate)**

25 ml soap
0.5 gram PbO
500 ml water
mix, and then decant water

Add Calcium Sulfate powder 4 grams. And mix.
Adjust pH with sulfuric acid to pH = 7

Add 10 ml of 0.2% Nalco Ultimer 1452 and mix. Clumping happens in seconds
Filter water.
Reaction is slower. Water is not completely clear.

When reviewing all of the water results Iron sulfate appears to yield good lead results 8PPB and superior phosphate(1.6PPM) results. However, calcium chloride yields the best lead results(less than 1 PPB) at pH 8.

In view of these results, it appears that ferric chloride and pH 8 would yield the best results. Ferric chloride should produce the lowest lead and phosphate levels over the broadest range of pH that most municipal water treatment plants accept(pH 5 to 9). In addition, lead phosphate, lead chloride, and iron phosphate are all highly water insoluble. The potassium chloride produced yields a common ion effect that makes lead , iron , and phosphate salts even more water insoluble. The sulfate ion completes with the phosphate ion which in turn produces higher phosphate levels.

Laundry Soap:

The laundry soap continues to yield good results. The water was treated with magnesium sulfate and the pH adjusted to 7. The lead level increased to 83 PPB therefore pH 7.5 may be preferred. The phosphorous level was (385 PPM)
A second sample was treated with iron sulfate and the pH adjusted to 7 this gave low lead 8 PPB and low phosphorus (1.6 PPM). Iron gave the best results in both cases.

LAUNDRY SOAP RESULTS

Sample ID	K3PO4	Na3KPO4	Kstearate	Na laurate	MgSO4	AlSO4	pH	lead in PPB
A	X				X		8.7	71
B	X					X	7.0	90
C	X		X		X		8.5	39
D	X		X		X		7.5	less than 5
E	X			X	X		8.0	6

The goal is prove the full range of the new soap.
Aluminum is implicated in Alzheimers disease best kept to less than 200 PPB
Iron 300 PPB (limit due to staining, and metallic taste)
Chloride 250 PPM(limit due to salty taste)
Calcium no restriction
Phosphate minimal restriction
Drinking water requirement is much higher 6.5 to 8.5 Target is 7 to 8.5 ,15PPB for lead used to be 50 PPB, sewer much less stringent pH 5 to 10 OK , heading to 6 to 10 to minimize corrosion problems. Metal level requirements are also much less.

I prefer to meet drinking water standards because it doesn't cost anymore to attain these levels. Calcium Chloride achieves these levels. However, iron chloride keeps phosphate levels low at acid pH levels

Experiment Iron chloride sample at pH 5, 7 and 9.
Calcium Carbonate is worth one test, simply because it is so cheap and leaves the water so clean. The big question is will it react with potassium phosphate to form calcium phosphate and potassium carbonate. Calcium carbonate and lead carbonate are highly insoluble.
The more concentrated the soap the better. Shipping costs can easily dominate the price of a product.
SAMPLE A
25 GRAM SOAP
500 ML WATER
0.5 GRAM LEAD OXIDE
Mix and filter
Add 3 grams calcium carbonate mix
PH remained at 12, pH adjusted to 9 with hydrochloric acid. 5 grams of 0.2% of Nalco Ultimer1452 added . Water cleared and settled rapidly. Very little hydrochloric acid was required to adjust the pH.
198 ppm phosphate 1 ppb lead
Sample B
25 GRAM SOAP
500 ML WATER
0.5 GRAM LEAD OXIDE
Mix and filter

It takes very little Ferric Chloride to adjust the pH to 6 . However, it take 50 grams of 0.2% of Nalco Ultimer1452 polymer to get the iron to fall out. In addition, when just enough ferric chloride is used to produce pH 9,8,7 or even 6.5 the iron does not fall out. Therefore, ferric salts are only desirable when large phosphate knock down at acidic pH (6) is required. The clarity is not as good as with calcium chloride

Calcium chloride remains the precipitant of choice. Adjust pH with Hydrochloric acid
49 ppm phosphate 2 ppb lead
Sample C
25 GRAM SOAP
500 ML WATER
0.5 GRAM LEAD OXIDE
Mix and filter
Add 2.5 grams calcium chloride mix
PH fell to 8.5 upon the addition of calcium chloride alone. 5 grams of 0.2% of Nalco Ultimer1452 added . Water cleared and settled .
1.5 ppm phosphate 2.5 ppb lead

Ferric chloride can be used in small amounts to trim phosphate levels.

Water Treatment
Add calcium chloride to match soap input then adjust pH to 8.5 with hydrochloric acid / calcium hydroxide
Add 5 grams of 0.2% Nalco Ultimer 1452

Calcium chloride at pH= 8.5 yields the best lead 1PPB and phosphate 1.5 PPM results
Ferric chloride yields great lead 2 PPB and moderate phosphate 49 PPM at pH = 6.
Calcium carbonate at pH=9 yields 1PPB lead and phosphate of 198 PPM.